WHAT IS CLAIMED IS:

1. A shape measurement method comprising the steps of:

applying one of an electromagnetic wave and a beam of charged particles to a surface of a specimen, using an irradiation unit that moves along an axis parallel to a scanning direction relative to the surface of the specimen;

measuring a signal intensity of one of an electromagnetic wave reflected from the surface of the specimen and a beam of charged particles generated from the surface of the specimen as a result of irradiation from the irradiation unit;

calculating a slope angle of the surface of the specimen at a position irradiated with one of the electromagnetic wave and the beam of charged particles on the basis of the measured signal intensity;

determining candidates for cross-sectional shape of the specimen on the basis of the calculated slope angle;

estimating a signal intensity of one of an electromagnetic wave that would be reflected from a surface having a cross-sectional shape of each of the candidates and a beam of charged particles that would be generated from the surface having a cross-sectional shape of each of the candidates if an angle of incidence of one of the electromagnetic wave and the beam of charged particles with respect to the surface having a cross-sectional shape of each of the candidates were changed to a specific angle of incidence different from an angle of incidence of one of the electromagnetic wave and the beam of charged particles applied to the surface of the specimen;

comparing the estimated signal intensity with a signal intensity obtained by measurement performed when the angle of incidence of one of the electromagnetic

wave and the beam of charged particles applied to the surface of the specimen is changed to the specific angle of incidence; and

determining the cross-sectional shape of the specimen on the basis of a result of the comparing step.

2. A shape measurement method according to claim 1, in which the irradiation unit further moves along an axis perpendicular to the scanning direction relative to the surface of the specimen, the shape measurement method further comprising the steps of:

accumulating the determined cross-sectional shape each time when the irradiation unit moves along the axis perpendicular to the scanning direction; and

determining a three-dimensional shape of the specimen on the basis of a result of the accumulating step.

3. A shape measurement method according to claim 1, wherein the step of calculating the slope angle of the surface of the specimen at a position irradiated with one of the electromagnetic wave and the beam of charged particles is performed using the measured signal intensity and multiple parameters selected from various kinds of parameters relating to the cross-sectional shape of the specimen.

4. A shape measurement method according to claim 3, wherein the multiple parameters to be used are selected among those serving to reduce a difference between the measured signal intensity and the estimated signal intensity.

5. A shape measurement method according to claim 3, wherein the multiple parameters are repeatedly selected until a difference between the measured signal intensity and the estimated signal intensity is reduced to a minimum.

6. A shape measurement method according to claim 3, wherein the candidates for cross-sectional shape that have been determined, the cross-sectional shape that has been determined, and the multiple parameters that have been selected are stored in a database.

7. A shape measurement method according to claim 1, wherein when the angle of incidence of one of the electromagnetic wave and the beam of charged particles applied to the surface of the specimen is changed to the specific angle of incidence, one of an angle of placement of the specimen and an angle of irradiation of the irradiation unit is changed while the other of the angle of placement of the specimen and the angle of irradiation of the irradiation unit is fixed at a predetermined angle.

8. A shape measurement apparatus comprising:

an irradiation unit that applies one of an electromagnetic wave and a beam of charged particles to a surface of a specimen, while moving along an axis parallel to a scanning direction relative to the surface of the specimen;

a signal intensity measurement unit that measures a signal intensity of one of the electromagnetic wave reflected from the surface of the specimen and the beam of charged particles generated from the surface of the specimen as a result of irradiation from the irradiation unit;

a cross-sectional shape candidate determination unit that calculates a slope angle of the surface of the specimen at a position irradiated with one of the electromagnetic wave and the beam of charged particles on the basis of the signal intensity measured in the signal intensity measurement unit, and determines candidates for cross-sectional shape of the specimen on the basis of the calculated slope angle;

a signal intensity estimation unit that estimates a signal intensity of one of an electromagnetic wave that would be reflected from a surface having a cross-sectional shape of each of the candidates and a beam of charged particles that would be generated from the surface having a cross-sectional shape of each of the candidates if an angle of incidence of one of the electromagnetic wave and the beam of charged particles with respect to the surface having a cross-sectional shape of each of the candidates were changed to a specific angle of incidence different from an angle of incidence of one of the electromagnetic wave and the beam of charged particles applied to the surface of the specimen; and

a cross-sectional shape determination unit that compares the signal intensity estimated in the signal intensity estimation unit with a signal intensity obtained by measurement performed in the signal intensity measurement unit when the angle of incidence of one of the electromagnetic wave and the beam of charged particles applied to the surface of the specimen is changed to the specific angle of incidence, and determines the cross-sectional shape of the specimen on the basis of a result of the comparison.

9. A shape measurement apparatus according to claim 8, wherein the irradiation unit further moves along an axis perpendicular to the scanning direction relative to the surface of the specimen; and

wherein the cross-sectional shape determination unit accumulates the determined cross-sectional shape each time when the irradiation unit moves along the axis perpendicular to the scanning direction, and determines a three-dimensional shape of the specimen on the basis of the accumulated cross-sectional shapes.

10. A shape measurement apparatus according to claim 8, wherein the cross-sectional shape candidate determination unit uses the signal intensity measured in the signal intensity measurement unit and multiple parameters selected from various kinds of parameters relating to the cross-sectional shape of the specimen to calculate the slope angle of the surface of the specimen at a position irradiated with one of the electromagnetic wave and the beam of charged particles.

11. A shape measurement apparatus according to claim 10, wherein the cross-sectional shape determination unit instructs the cross-sectional shape candidate determination unit to select the multiple parameters among those serving to reduce a difference between the signal intensity measured in the signal intensity measurement unit and the signal intensity estimated in the signal intensity estimation unit.

12. A shape measurement apparatus according to claim 10, wherein the cross-sectional shape determination unit instructs the cross-sectional shape candidate determination unit to repeatedly select the multiple parameters until a difference between the signal intensity measured in the signal intensity measurement unit and the signal intensity estimated in the signal intensity estimation unit is reduced to a minimum.

13. A shape measurement apparatus according to claim 10, wherein the candidates for cross-sectional shape that have been determined in the cross-sectional shape candidate determination unit, the cross-sectional shape that has been determined in the cross-sectional shape determination unit, and the multiple parameters that have been selected in the cross-sectional shape candidate determination unit are stored in a database.